

**GUP Y**Claims

1.

A method for increasing oil recovery from an oil reservoir in which method gas is injected into the reservoir, comprising the steps of:

- separation of air into an oxygen-rich fraction and a nitrogen-rich fraction,
- providing a natural gas stream and leading the natural gas stream and at least a part of the oxygen-rich fraction to a reformer for conversion to synthesis gas mainly comprising  $H_2$ , CO,  $CO_2$  and lower amounts of non-converted methane, water vapor and nitrogen,
- formation of methanol or other oxygenated hydrocarbons or higher hydrocarbons from the synthesis gas in a synthesis unit,
- withdrawing raw synthesis products and a waste gas from the synthesis unit, and
- injecting the nitrogen-rich fraction and at least a part of the waste gas into the oil reservoir to increase the oil recovery from the reservoir,

2.

A method according to Claim 1, wherein all or some of the waste gas from the synthesis unit is sent to a  $CO_2$  recovery unit including a CO shift converter where  $CO_2$  is removed and injected into the reservoir and the remaining hydrogen-rich stream is used for other purposes.

3.

Method according to claim 1 or 2, wherein steam or water generated during the syngas production and/or synthesis is injected into the reservoir.

4.

A plant for providing gas for downhole injection for pressure support in an oil reservoir for recovering of hydrocarbons and production of oxygenated hydrocarbons or higher hydrocarbons from natural gas, comprising:

- an air separation unit (2) for production of an oxygen-rich fraction for supply to processes that require oxygen, and a nitrogen-rich fraction for injection;

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- a reformer (8) for conversion of a mixture of natural gas, water and oxygen or oxygen enriched air from the air separation unit into a synthesis gas comprising mainly  $H_2$ , CO,  $CO_2$  and small amounts of methane in addition to any inert gas, such as nitrogen;
  - 5    – a synthesis unit (15, 56) for conversion of the synthesis gas for synthesis of oxygenated hydrocarbons, or for synthesis of higher hydrocarbons;
  - means for injecting gas (6) into the reservoir;
  - means for transferring nitrogen from the air separation unit to the means for injecting gas; and
  - 10   – means for transferring at least a part of a waste gas from the synthesis unit to the means for injecting gas.
- 5.
- 15   A plant according to Claim 4, additionally comprising a tail gas treatment unit (63) for removing CO by a shift reaction and separation of hydrogen from the remaining tail gas.
- 6.
- Plant according to claim 5, comprising means (65) for transferring the remaining tail gas from the tail gas treatment unit (63) to the means for injecting gas (6).
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- 7.
- Plant according to any of the claims 4 to 6 wherein the synthesis unit (15, 56) comprises one or more once-through Fischer-Tropsch units for synthesis of higher hydrocarbons.
- 25   8.
- Plant according to claim 7, comprising means for introducing all or parts of the separated hydrogen from the tail gas treatment unit (63) into the Fischer-Tropsch loop to adjust the  $H_2/CO$  ratio to a desired level.